ArtSim: Improved estimation of current impact for recent articles

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AIMinScience 2020
1st International Workshop on Assessing Impact and Merit in Science

Problem definition (1/2)

- Plethora of available scientific articles
- *Scientific impact* can be defined in many ways [1]
- Variety of measures aiming to quantify scientific impact
- Practical applications
    - Keyword search results
    - Literature exploration
    - Articles comparison

[1] Bollen, J., Van de Sompel, H., Hagberg, A., Chute, R.: A principal component analysis of 39 scientific impact measures. PloS one (2009)

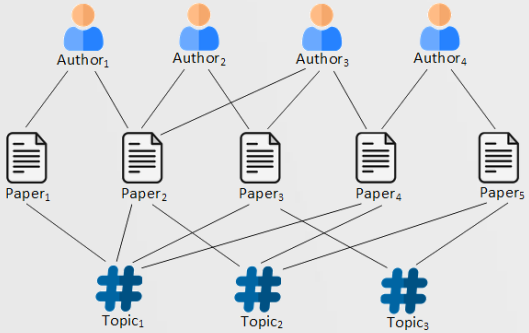
Problem definition (2/2)

- Estimate *popularity* or *hype* of an article i.e. its current impact
- Most popularity measures rely on citation history
- Recent articles have limited citation history
    - Their impact estimation is prone to inaccuracies
    - Existing measures fail to provide correct estimations

Our approach (1/3)

- ArtSim: a novel approach to assess article popularity
- Similar articles share similar popularity dynamics
- ArtSim considers similar articles with more complete citation history
- Scholarly Knowledge Graphs are used to compute article similarity
- Article similarity based on author lists and topics

Our approach (2/3)

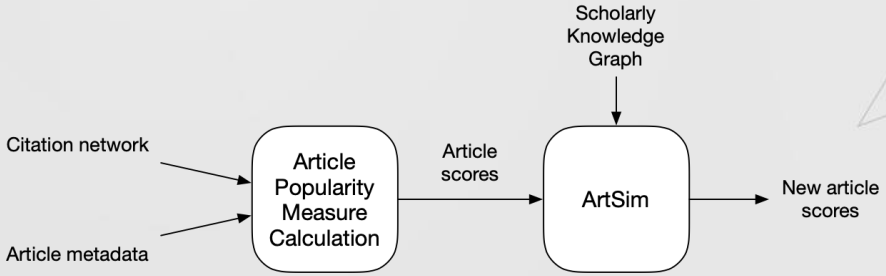


- Knowledge Graphs encode rich domain-specific information
- A *metapath* is a path in the network schema
  - APTPA relates authors that have published papers in the same topics
- ArtSim calculates *metapath-based similarity* between papers [2]

[2] Xiong, Y., Zhu, Y., Yu, P.S.: Top-k similarity join in heterogeneous information networks. IEEE Transactions on Knowledge and Data Engineering (2015)

Our approach (3/3)

- ArtSim can be applied on top of any popularity measure
- ArtSim transforms scores of recent papers using article similarity
- $S(p) = \begin{cases} a * S_{PAP}(p) + \beta * S_{PTP}(p) + \gamma * S_{initial}(p), & p.year \geq t_c - y \\ S_{initial}(p) & , \quad otherwise \end{cases}$
- $\alpha, \beta, \gamma \in [0, 1]$ and $\alpha + \beta + \gamma = 1$



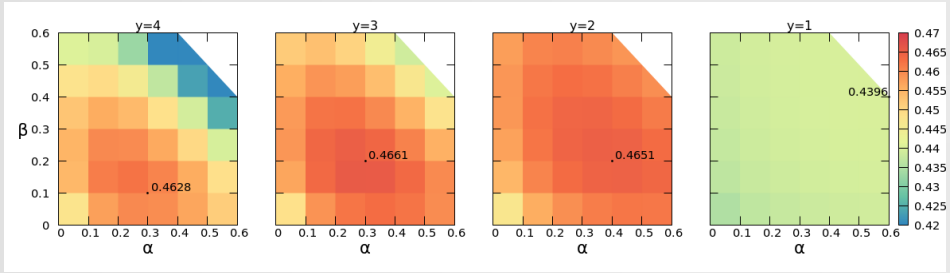
Evaluation (1/5)

- Datasets
  - DBLP Scholarly Knowledge Graph
  - DBLP Article Similarities (https://zenodo.org/record/3778916)
- Ground truth: total rankings of papers based on their short term future citations [3]
- Measures: Kendall's τ and nDCG@k
- Best performing popularity measures [3]
  - Retained Adjacency Matrix (RAM)
  - Effective Contagion Matrix (ECM)
  - CiteRank (CR)
  - FutureRank (FR)

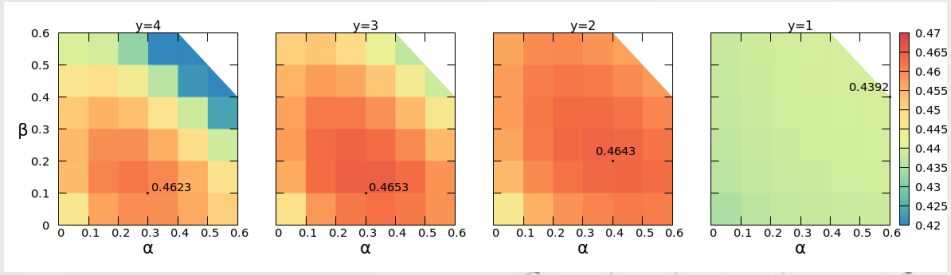
[3] Kanellos, I., Vergoulis, T., Sacharidis, D., Dalamagas, T., Vassiliou, Y.: Impactbased ranking of scientific publications: A survey and experimental evaluation. IEEE Transactions on Knowledge and Data Engineering (2019).

Evaluation (2/5)

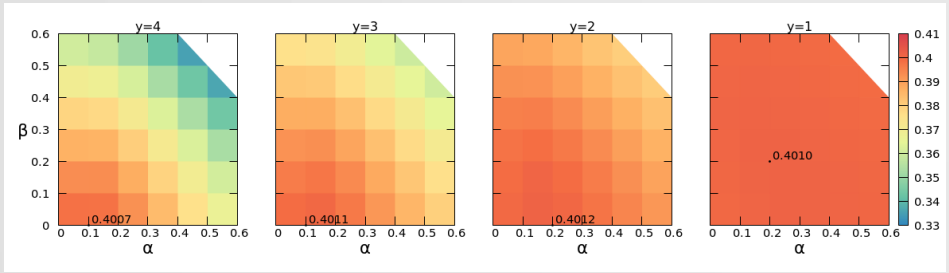
Effectiveness of our approach for different parameters in terms of Kendall's τ correlation



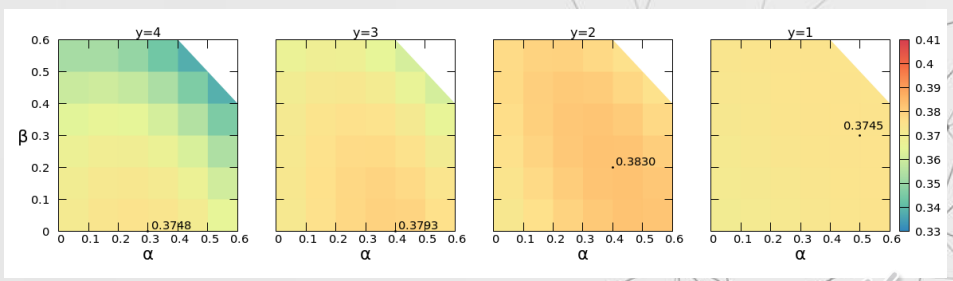
ECM



RAM



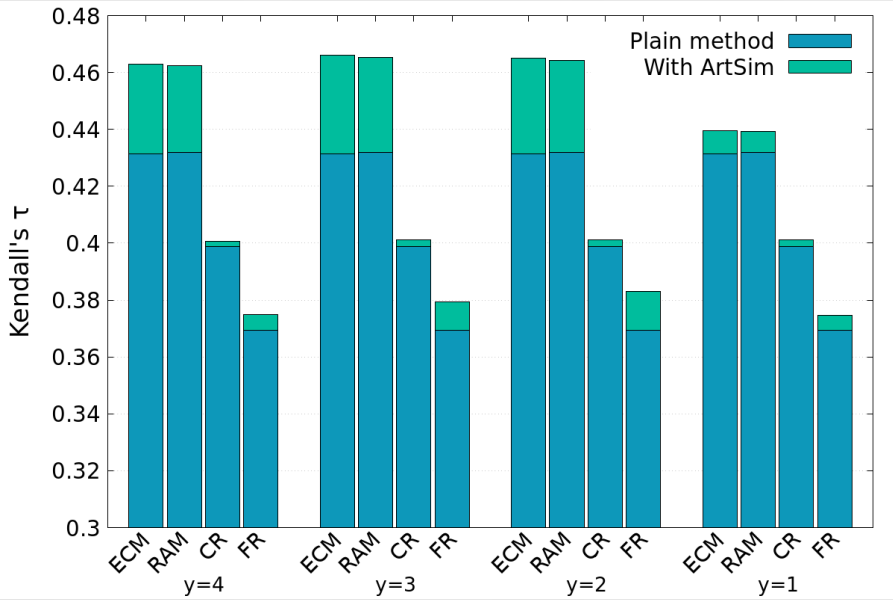
CR



FR

Evaluation (3/5)

Effectiveness of our approach in terms of Kendall's τ correlation for best parameterization per year



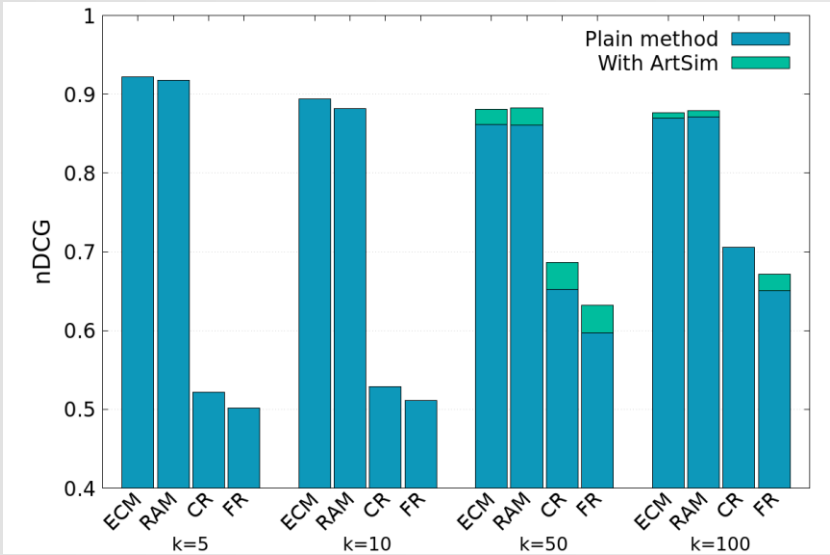
Evaluation (4/5)

Effectiveness of our approach for y = 3 in terms of nDCG@k

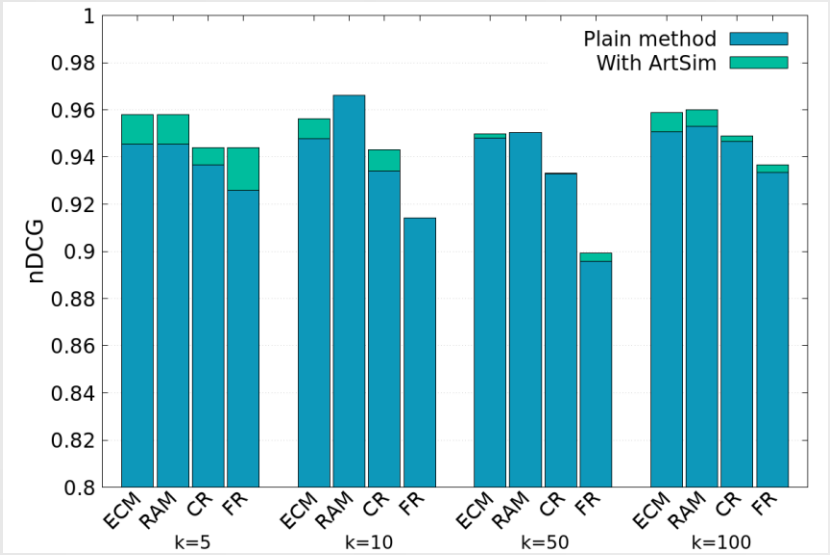
	Small values of k			Large values of k		
	5	**50**	**500**	**400,000**	**500,000**	**600,000**
ECM	0.8323	0.8634	0.8953	0.8780	0.8833	0.8884
ArtSim-ECM	0.8323	0.8634	0.8953	**0.8837**	**0.8912**	**0.9003**
RAM	0.8588	0.8521	0.8943	0.8774	0.8842	0.8881
ArtSim-RAM	0.8588	0.8521	0.8943	**0.8836**	**0.8904**	**0.9008**
CR	0.3530	0.5263	0.6060	0.7904	0.8149	0.8272
ArtSim-CR	0.3530	0.5263	0.6060	**0.7983**	**0.8199**	**0.8307**
FR	0.3403	0.5018	0.5526	0.7586	0.7934	0.8101
ArtSim-FR	0.3403	0.5018	0.5526	**0.7731**	**0.7961**	**0.8152**

Evaluation (5/5)

Effectiveness of our approach for y = 3 in terms of nDCG for different keyword search scenarios with y = 3 and varying k



Expert Finding



Recommender Systems

Summarizing

- ArtSim can be applied on top of existing popularity measures to increase the accuracy of their results
- Popularity of papers in their cold start period can be better estimated based on the characteristics of other, similar papers
- Experimental evaluation showcases the effectiveness of ArtSim

Thank you for your attention!

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Co-financed by Greece and the European Union